

## **EXECUTIVE SUMMARY**

The United States Environmental Protection Agency (EPA) is submitting this Report to Congress in accordance with section 431(b) of the Department of Veterans Affairs and Housing and Urban Development and Independent Agencies Appropriations Act of 2000, Public Law 106-74 (1999). The Appropriations Act directed EPA to conduct an evaluation of the Phase I Storm Water Program as follows:

No later than 120 days after the enactment of this Act, the Environmental Protection Agency shall submit to the Environment and Public Works Committee of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a report containing a detailed explanation of the impact, if any, that the Phase I program has had in improving water quality in the United States (including a description of specific measures that have been successful and those that have been unsuccessful).

In response to the mandate of the Appropriations Act, EPA conducted a review of existing and readily available information on the status and effectiveness of the Phase I storm water program. This review has led the Agency to the following findings:

- Although information on the water quality impacts of Phase I is unavailable at the national level, loading reductions and subsequent water quality impacts have been documented on the site-specific level.
- The fundamental approach for addressing storm water discharges under the Phase I program involves the use of site-specific storm water pollution prevention plans (SWPPPs) and best management practices (BMPs). These measures or practices, used to reduce the amount of pollution entering water bodies, can be implemented cost-effectively.
- The flexible nature of the program has encouraged innovation on the part of municipalities, construction operators, and industrial facilities and allowed them to tailor control programs to their own unique circumstances.
- Further improvements can be made in both program design and implementation to enhance effectiveness.

In developing this Report to Congress, EPA was aware that the issue of storm water impacts to surface waters pre-dated the Phase I program. EPA wishes to acknowledge and applaud the efforts of many entities to address the potential impacts on water quality associated with storm water discharges prior to the Phase I program. These efforts include for example, various

regulatory and voluntary programs initiated at the State and local level. As discussed further below, EPA accounted for many of these ongoing efforts in developing the Phase I rule, in the form of providing flexibility in rule implementation to account for existing and applicable programs or efforts. As a result, and specifically while preparing this Report, EPA at times found it difficult to distinguish between successful efforts attributable to the Phase I program and successful storm water control efforts that pre-date or were developed in parallel with the Phase I program. The Agency took a relatively conservative approach to contend with this issue, crediting success to the Phase I program only when efforts were directly attributable to the program. At the same time, this report acknowledges the many other efforts that have been and are being folded into the Phase I program as it matures. Where there is uncertainty related to the direct attribution of individual successes to the Phase I program, the Report provides appropriate caveats.

## **BACKGROUND**

The primary objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. To achieve this objective, the CWA establishes a variety of programs to control the discharge of pollutants to waterways. Section 402 of the CWA established the National Pollutant Discharge Elimination System (NPDES) permit program to specifically control the discharge of pollutants from point source dischargers. EPA has been implementing the NPDES program since 1972. The program initially focused on industrial sources and municipal wastewater treatment plants and has made dramatic gains. In the Water Quality Act (WQA) of 1987, Congress directed EPA to control storm water discharges.

Section 402(p) of the WQA requires the development and implementation of regulations in two phases to control storm water discharges. In promulgating the Phase I storm water regulations, EPA recognized that:

- The regulations had to meet the intent of the provisions of the CWA as established by Congress.
- Many industries, municipalities, and States were already implementing storm water control programs (e.g., soil and erosion control programs), and EPA wanted to encourage their success and expand those successes to other jurisdictions and industries.
- The Phase I program would bring previously unregulated parties into the NPDES program.

Consequently, EPA promulgated relatively flexible Phase I regulations that provided broad requirements while allowing for site-specific measures for achieving compliance. By choosing this performance-based regulatory approach, EPA sought to meet congressional intent while avoiding duplication of effort where significant progress had already been made. Through the requirement

to develop site-specific storm water management programs, EPA also acknowledged that industrial facilities and municipalities are in the best position to determine the appropriate combination of storm water management practices for their own circumstances.

The regulations, promulgated on November 16, 1990 (55 FR 47990), require NPDES permits for discharges from two broad categories of storm water discharges: (1) municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more and (2) discharges associated with industrial activity (including discharges from construction activities disturbing 5 acres or greater of total land area). A definition of each of these regulated parties, along with a short summary of associated requirements, follows.

**Municipal Separate Storm Sewer Systems (MS4s).** An MS4 is a conveyance or system of conveyances that is owned or operated by a Federal, State, or local government entity and is designed for collecting and conveying storm water (which is not part of a publicly owned treatment works). The November 1990 regulations specifically identified 220 municipalities whose MS4s were subject to the Phase I program. The municipalities were required to submit applications that identified a variety of site-specific pollution prevention measures, source controls, and BMPs to control pollutants from targeted sources within the municipality. Phase I MS4s were to develop storm water management programs that included identifying major outfalls and pollutant loadings; detecting and eliminating non-storm water discharges to the storm sewer system; using pollution prevention techniques to reduce pollutants in runoff from industrial, commercial, and residential areas; and controlling storm water discharges from new development and redevelopment areas.

**Storm Water Discharges Associated with Industrial Activities.** The Phase I program also addresses storm water runoff from industrial facilities. Regulated facilities must develop and implement a site-specific storm water pollution prevention plan (SWPPP) to prevent, reduce, or control storm water pollutant sources using, among other techniques, low-cost BMPs. Common BMPs include good housekeeping, employee training, site inspections, spill prevention and response, and preventive maintenance activities.

EPA and authorized States have relied on the use of general permits as the primary mechanism for providing permit coverage for storm water discharges associated with industrial activities. Currently, EPA's 1995 multi-sector general permit (60 FR 50804, September 29, 1995) identifies storm water control guidelines for 30 different industrial sectors. The general permit's most significant requirement is development and implementation of a site-specific SWPPP.

**Storm Water Discharges Associated with Construction Activities.** Under the Phase I program, "storm water discharge associated with industrial activity" includes storm water discharges from construction activities (including grading, clearing, excavation, or other earthmoving activities) that result in the disturbance of 5 or more acres of total land area. EPA's strategy for issuing NPDES permits for storm water discharges from construction activities is similar to that for industrial activities, that is the issuance of general permits.

The baseline general permit for construction activities requires development and implementation of a site-specific SWPPP specifying erosion and sediment control measures that will be implemented at the site. Examples of these BMPs include controls designed to retain sediment on site; controls that prevent litter, construction debris, and construction chemicals from becoming a pollutant; and interim and permanent stabilization practices to preserve existing vegetation.

## DATA SOURCES AND METHODOLOGY

Given the 120-day deadline to submit this Report to Congress, EPA has relied primarily on existing and readily available data and information. Information used for this Report generally falls into the following three categories:

1. **Case studies.** This Report documents specific efforts, programs, and initiatives used by individual permittees to comply with Phase I requirements. The case studies mainly provide detailed information related to how the Phase I program is being developed and implemented by individual permittees. The case studies are discussed throughout the Report, and a detailed summary of each case study is provided in Appendix D.
2. **Existing surveys.** This Report uses the results of several existing surveys and data collection efforts:
  - S** A limited EPA survey of nine Phase I MS4s conducted for this Report, assessing a range of indicators for their storm water management programs.
  - S** A limited survey of ten Phase I MS4s that the National Association of Flood and Storm water Management Agencies (NAFSMA) conducted for this Report of its members to solicit input related to the effectiveness of the Phase I program.
  - S** A 1996 survey and study performed by the Water Environment Federation (WEF) of industrial facilities to assess the effectiveness of the industrial storm water general permitting program.
3. **Modeling.** EPA performed some limited modeling to extrapolate data, information, and results to provide a broader (national or regional) indication of the contributions of the Phase I program.

EPA used three types of indicators to measure program effectiveness for this Report:

1. **Programmatic Indicators.** Programmatic indicators are measures of the effectiveness of administrative activities undertaken by permitting authorities and the regulated community.
2. **Loading Reductions.** This Report describes (1) actual or estimated reductions in loadings of various pollutants achieved in specific cases as a result of Phase I BMPs and (2) estimated national loadings of sediment averted as a result of Phase I controls. Although the Appropriations Act specifically requested information on water quality improvements that have resulted from implementing Phase I, EPA does not have this data readily available and could not collect it in time to meet the deadline for the report. Another equally significant measurement of the Phase I program's progress is the degree to which water quality was protected from degradation.
3. **Direct Measures of Water Quality Improvements.** In this Report, EPA provides subjective and objective assessments on a site-specific basis and through qualitative surveys of the water quality benefits attributable to the Phase I program.

This Report to Congress is organized as follows:

- **Chapter 1** provides background information on the Phase I program.
- **Chapter 2** summarizes the methodology used to respond to Congress's request.
- **Chapter 3** presents EPA's evaluation of the Phase I storm water program for municipal separate storm sewer systems.
- **Chapter 4** presents EPA's evaluation of the Phase I storm water program for construction activities.
- **Chapter 5** presents EPA's evaluation of the Phase I storm water program for industrial activities.

## FINDINGS

This Report documents a number of specific cases where the Phase I storm water control program has contributed to water quality protection and improvement. When EPA initiated this study, it was unclear whether the Agency would be able to attribute water quality improvements to the program. EPA recognized that the wide variety of pollutant sources, including for example in-place contaminated sediments, airborne deposition, and other point and nonpoint sources, would complicate any attempt to attribute water quality improvements to a single program. EPA also

recognized that water quality improvement was not the only goal of the program, but that prevention of degradation would be a major, although difficult-to-quantify, goal. Notwithstanding these complications, this Report does provide objective and subjective site-specific evidence that the loading reductions achieved through the application of best management practices (BMPs) have resulted in water quality benefits. In addition, EPA's experience with other water quality management programs suggests that water pollution control efforts do not necessarily result in immediate, recognizable environmental results, but may instead produce long-term improvements that must be tailored and refined over time and coordinated with other environmental protection programs. Thus, EPA expects additional evidence of water quality improvements attributable to Phase I to become available in the future, as the program matures.

The available evidence suggests that the regulated community agrees with the overall approach EPA has taken to implement the Phase I program, as evidenced by WEF's large survey of industrial facilities and the smaller, focused surveys of the municipal community by EPA and NAFSMA. From the perspective of the regulated community, EPA's approach to implementing Phase I has allowed permittees to tailor their storm water programs to meet site-specific needs.

### **Impacts of the Phase I Program**

*Although information on the water quality impacts of Phase I is unavailable at the national level, loading reductions and subsequent water quality impacts have been documented at the site-specific level.*

Except for storm water discharges associated with construction activities, EPA does not have national estimates of water quality protection and improvements from the Phase I program. This Report does, however, provide survey and case study data identifying specific instances where water quality improvements have resulted, or are expected to result, from implementation of the Phase I program. Examples of loading reductions and subsequent water quality protection and improvements are provided below.

#### **Loading Reductions**

Phase I regulations are intended to protect and improve water quality by reducing pollutant loadings to the Nation's waters. A modeling analysis conducted for this Report estimates that storm water BMPs applicable to construction sites keep 73 percent of the sediments generated during construction from reaching surface water bodies. Using the average sediment load reduction per site (46.4 tons per site) and estimates of the number of permitted construction starts in 1999 (19,856 sites), the use of SWPPPs and BMPs has prevented at least 882,000 tons of sediment from entering the Nation's waters. The Phase I program has expanded the use of such measures by requiring them for all sites nationally that disturb 5 or more acres.

Specific case studies cited in this Report also document loading reductions as a result of storm water control programs, many of which were developed or enhanced as a result of Phase I. Case study findings include the following:

- By eliminating illicit connections to their MS4, Portland, Oregon, reduced annual pollutant loads due to wash water discharges, accidental spills, and erosion/sedimentation by 1,980 pounds of total suspended solids (TSS), 330 pounds of biochemical oxygen demand (BOD), 40 pounds of nitrogen, 10 pounds of phosphorous, 400 pounds of diesel fuel, and 4 pounds of oil and grease.
- Three storm water ponds in Austin, Texas's Central Park area provide environmental, economic, and aesthetic benefits. By capturing 300,000 cubic feet of rainfall runoff, the ponds annually remove 36,400 to 50,000 pounds of sediment, 55 to 275 pounds of nitrate/nitrite, 55 to 2000 pounds of phosphorous, 5 to 50 pounds of lead, and 10 to 150 pounds of zinc. Additional downstream benefits include improved oxygenation and flooding and erosion control.
- In Palo Alto, California, implementation of BMPs at vehicle service facilities significantly reduced concentrations of several toxic metals in storm water including copper (89 percent), lead (96 percent), nickel (93 percent), and zinc (77 percent) between 1993 and 1996.
- In Tulsa, Oklahoma, monitoring data from an iron foundry identified elevated levels of TSS in storm water discharges from the facility. The facility was able to reduce concentrations of TSS in its storm water discharges by 90 percent compared to their pre-phase I baseline through the implementation of BMPs, such as improved housekeeping, and the addition of a filtering system and storm water retention basin to promote settling.
- Prince George's County, Maryland's Low-Impact Development (LID) program uses a wide array of simple, cost-effective BMPs that infiltrate storm water runoff from new developments. LID techniques decrease runoff generation by between 75 and 95 percent from earlier land development designs, and, on a composite basis, are estimated to reduce nutrient and metal pollutant loadings by over 80 percent. Prince George's County has been piloting the LID program since the early 1990's, and has recently incorporated the program into their storm water management plan.
- Montgomery County, Maryland's structural BMPs prevented 23 percent of the potential sediment load (in the absence of BMPs) and 27 percent of the potential nitrogen load within its jurisdiction from entering streams in 1998.

## Water Quality Results

As noted above, EPA was not able to conduct a national assessment of the water quality protection and improvement afforded by the Phase I program. Consequently, this Report documents water quality protection and improvement as identified in qualitative surveys and specific case studies.

Surveys of the regulated community indicate that respondents believe that water quality protection and improvement have been achieved and that additional protection and improvement will be evidenced in the future. For example, of those industrial respondents to the WEF survey that had collected monitoring information, over 74 percent stated that their monitoring data indicated at least some improvement in water quality or a reduction in pollutant loadings as a result of Phase I implementation. Additionally, most of the participants in NAFSMA's limited survey of Phase I permittees responded that the program has been successful in improving local water quality. The remaining respondents indicated that it is too early to determine water quality impacts.

- Salt Lake City, a NAFSMA respondent, stated that its Phase I program has improved the quality and quantity of storm water discharges and protected water quality. The City attributed programmatic success to the public information/education and construction management program.
- Within the North Carolina Department of Environment and Natural Resources, the Division of Land Resources (administering the Sedimentation Control Program) and the Division of Water Quality (administering the NPDES storm water program) have successfully integrated their functions to develop a comprehensive construction storm water program. Beaverdam Creek, a primary nursery area and high-quality water, had experienced turbidity exceedances due to poorly managed construction activities. Successful program integration enabled North Carolina to curb poor management practices at construction sites in Brunswick County, North Carolina, and thus prevent impacts to water quality.
- A Phase I storm water construction permit in Grays Harbor County, Washington provided the mechanism to ensure that the development of a major Department of Corrections (DOC) facility would not threaten the nearby wetlands and salmon habitat of Stafford Creek and other surrounding water bodies. Before full implementation of the SWPPP, water quality exceedances of turbidity standards were noted. After SWPPP implementation, there were no water quality exceedances.
- The Washington Department of Ecology found the Phase I program to be instrumental in addressing discharges to valuable ecological and drinking water resources, including Issaquah Creek, Valley Creek, and Salmon Creek.



Additionally, as part of this Report, EPA conducted a statistical analysis of the relationship between water quality and the implementation of storm water controls in Florida. That analysis provided limited evidence of a positive relationship between the implementation of storm water controls on construction activities and the key water quality parameter of total suspended solids.

To comply with the Appropriations Act, EPA has also identified successful and unsuccessful measures of the Phase I program. These measures are recounted below.

### **Successful Measures of the Phase I Storm Water Program**

*The fundamental approach for addressing storm water discharges under the Phase I program involves the use of site-specific storm water pollution prevention plans (SWPPPs) and best management practices (BMPs). These measures or practices, used to reduce the amount of pollution entering water bodies, can be implemented cost-effectively.*

As noted above, some of the case studies collected for this Report identify specific loading reductions and water quality benefits. The Phase I program is based on the use of low-cost, common-sense solutions that appear to be widely accepted by the regulated entities and the public. In implementing control measures, Phase I permittees can take advantage of a comprehensive “menu” of structural and nonstructural BMPs, selecting those that are most effective on a site-specific basis.

Indeed, 75 percent of industrial respondents to the WEF survey consider BMPs such as good housekeeping, visual inspections, employee training, spill prevention and response, and preventive maintenance to be both applicable and moderately or highly effective. In some cases, these “nonstructural” BMPs can also lead to economic benefits to a facility in areas such as materials management and inventory control principles.

Municipal surveys by EPA and NAFSMA, and the industry survey by WEF, point to two particular BMPs — illicit discharge control and public outreach and training — as being particularly effective components of municipal and industrial storm water management programs. Examples of the effectiveness of these two BMPs are provided below.

#### **Illicit Discharge Control**

- In Boston, Massachusetts, 23 illicit connections, including a discharge of 71,000 gallons per day of raw sewage, were found and eliminated. The Charles River’s environmental report card has improved from a “D” to a “B-minus” as the result of this and other wet weather control programs.
- Portland, Oregon’s Phase I program involves regular monitoring for pollutants at storm water outfalls and has effectively halted illicit pollutant discharges.

- According to WEF's survey of nearly 600 industrial facilities, elimination of industrial source discharges into storm drain systems was found to be highly or moderately effective by 85 percent of the respondents who found the technique to be applicable to their site.

### Training and Outreach

Six of nine respondents to the NAFSMA survey characterized public outreach and education as effective in reducing discharges from MS4s and in improving water quality. Case study information also shows that training and outreach activities are cost-effective and supported by the public.

- Fort Worth, Texas's aggressive public promotion of its household hazardous waste collection program, a component of its Phase I storm water management plan, has resulted in the annual collection of 50,000 gallons of toxic liquid wastes, preventing the release of these wastes to the environment.
- Charlotte, North Carolina (a Phase I permittee) has worked with Mecklenburg County (a Phase II permittee) to create a multifaceted program to protect their local water bodies — a program that has gained wide public support. Private citizens have volunteered to adopt over 40 miles of streams for cleanup and to stencil hundreds of storm drains to discourage illicit dumping.
- Outreach and training are effective for industrial programs as well. Nearly 90 percent of respondents to the WEF survey considered employee training a highly or moderately effective part of a SWPPP.

*The flexible nature of the program has encouraged innovation on the part of municipalities, construction operators, and industrial facilities and allowed them to tailor control programs to their own unique circumstances.*

Several elements of EPA's approach to implementing the Phase I program have encouraged innovation: (1) the program's administrative flexibility alleviates duplication of efforts between like programs, (2) EPA has mounted an extensive outreach campaign to ensure the regulated community is aware of its regulatory responsibilities, and (3) the regulated community has an appreciation of the program's purpose and approach.

### Program Flexibility

EPA explicitly recognizes the Phase I program's relationship to other Federal, State, and local storm water control programs. Indeed, in designing the program EPA avoided duplication of effort, emphasizing integration of programmatic requirements so States and localities could

leverage the Phase I program to support existing programs. Case studies documented in this Report, including those identifying the alignment between the Phase I construction program and soil and erosion control programs in North Carolina and Washington State, show that State and local programs have successfully integrated and leveraged the program to improve program administration and yield water quality benefits.

### Extensive Outreach Campaign

Because the Phase I regulations affects so many entities with no prior NPDES permitting experience, particularly in the construction sector, the program has included aggressive outreach since its inception. EPA found that tools such as a hotline, a full complement of guidance, training workshops, and an Internet-based web site have been used extensively by the regulated community. As noted in the WEF survey report, “it appears that both EPA and the States have done an excellent job in providing the necessary assistance to prepare a storm water management plan.”

### Stakeholder Support

As a result of the program’s flexibility and the fact that BMPs offer real loading reductions, many members of the regulated community support the program. When WEF asked regulated industries whether they would implement SWPPPs even in the absence of storm water regulations, almost 43 percent indicated they would retain SWPPPs in their entirety. Of these, 80 percent would retain SWPPPs because of the environmental benefit. More than one-half (52.3 percent) of the remaining respondents stated they would retain at least some of their SWPPPs even in the absence of regulations.

### **Measures Identified as Unsuccessful**

*Further improvements can be made in both program design and implementation to enhance effectiveness.*

As noted above, a sound program framework is in place to foster cost-effective implementation and loading reductions, and subsequent water quality protection and improvement have been evidenced. Nevertheless, information collected for this Report also identified measures of the Phase I storm water program that are considered less than successful. Those measures are discussed below, along with a summary of the Agency’s response.

1. Stakeholders have expressed concerns regarding the cost and usefulness of analytical monitoring conducted under Phase I.

The Phase I program's monitoring programs were established to characterize storm water discharges and to provide monitoring data for use in evaluating compliance. EPA has found that both the industrial community (as reflected in the WEF survey) and the municipal community (as reflected in the NAFSMA survey) are concerned about the Phase I monitoring program requirements.

- The requirements of EPA's general permit for industrial facilities specify analytical monitoring for certain industrial sectors. The purpose of the monitoring is to provide facility operators with the necessary information to determine the effectiveness of their SWPPPs in controlling the discharge of pollutants in storm water. EPA has received feedback from industry representatives that the costs associated with analytical monitoring are too high, and that the data generated are not useful in determining the effectiveness of their SWPPPs.

**Agency Response:** EPA is considering alternatives to the analytical monitoring requirements in EPA's general permit for storm water discharges associated with industrial activity, and will request public comment on alternatives to analytical monitoring requirements during proposal. The Federal Register notice for the proposed MSGP is expected in February 2000.

- Some Phase I municipalities have stated that uniform discharge monitoring requirements for MS4 permits have resulted in a significant expenditure of resources without a commensurate return in water quality improvement. These inefficiencies were particularly noted in areas where the standard Phase I end-of-pipe monitoring was considered inappropriate for the specific geographic and climatological locations of some MS4s (e.g., areas that experience infrequent rainfall events). In addition, some Phase I municipalities contend that MS4 monitoring requirements may not account for, or be integrated with other area-wide ambient monitoring efforts, characterization of other pollutant sources, and/or water quality modeling.

**Agency Response:** The Agency will continue to investigate and encourage innovative and integrated approaches to monitoring through policy, guidance, and technical assistance.

2. The industrial community, through the WEF survey, identified elements of the SWPPP that have proven ineffective.

Respondents to the WEF survey identified the following BMP measures as ineffective in controlling the discharge of pollutants in storm water:

- Record keeping and reporting
- Raw material and product substitution
- Site mapping.

**Agency Response:** While some respondents to the WEF survey did not feel the above measures are effective in controlling the discharge of pollutants in storm water, EPA feels they are important components of a comprehensive and effective SWPPP. Developing a facility site map, for instance, although not directly effective in controlling the discharge of pollutants, can be a very simple and effective exercise that provides an operator with a better understanding of the potential sources of pollutants exposed to storm water. The site map also provides the operator with a better understanding of the drainage areas from their facility, which should facilitate assessment of necessary controls. Accurate record keeping and reporting is essential to track compliance with SWPPP implementation requirements, as well as assist in anticipating areas of concern for storm water contamination (e.g., tracking the types and amounts of materials stored at the facility). With regard to measures that address “raw material and product substitution,” these are BMPs that facilities are to consider, and implement as appropriate and necessary.

## CONCLUSIONS

EPA’s analysis of the Phase I storm water program demonstrates that a flexible regulatory framework is in place for controlling storm water discharges from municipal, construction, and industrial sources. Many Phase I program components were found to be effective in preventing or reducing the discharge of pollutants in storm water in specific cases. Although EPA acknowledges that it does not currently have a system in place to measure the success of the Phase I program on a national scale, surveys and case studies described in this Report indicate that significant milestones are being achieved. This Report specifically provides evidence that the Phase I program has been successful in reducing pollutant loadings in storm water discharges and protecting and improving water quality on a site-specific basis. The Agency has worked with stakeholders, and will continue to do so, to identify meaningful measures for reporting the effectiveness of the Phase I storm water program in the future.

Finally, many Phase I municipalities agree that storm water management is a key component in multijurisdictional, multiwatershed efforts to protect receiving waters. Municipalities have stated that there are opportunities for integrating wet weather programs (storm water Phases I and II, combined sewer overflow, sanitary sewer overflow) to enhance efforts by municipalities and other stakeholders to manage wet weather flows on a watershed basis. The Agency will continue to look for ways to support innovative approaches to watershed protection through policy, guidance, and technical assistance.